A method and apparatus for shorthand processing of medical images, wherein mouse positionings and/or actuations will immediately control inherent image processing functions, and a pertinent computer program

BACKGROUND OF THE INVENTION

The invention relates to a method as recited in the preamble of Claim 1. A frequent problem is the excessive mouse travel needed to activate functions. For example, an image zooming operation activated through a button on a toolbar could run as follows:

5   1. Move cursor to button on toolbar

2. Click on button to activate zoom function

3. Move cursor over image

4. Perform zoom interaction with respect to image.

Steps 1 to 3 are required because the toolbar button must be pressed prior to

10   zooming. For a single dedicated operation this is tolerable, but when performing multiple operations on images the continual cursor movements to and from menu-bars, toolbars and or control panels become a nuisance.

On-screen toolbars and control panels cause distraction. The distraction increases with the amount of screen area reserved to user interface constructs. Workstation

15   screen area is scarce and should only be used to display essential information. For routine and diagnostic viewing this is the display of medical images. The model hereinafter requires no user interface constructs other than a region on the screen to display an image and associated graphics overlays. Since no screen area is used by extraneous user-interface constructs, diagnostic-viewing applications can emulate a light-box by using screen area predominantly

20   for image display.

SUMMARY TO THE INVENTION

In consequence, amongst other things, it is an object of the present invention to provide access to various common image display manipulations without associating

25   thereto user interface elements that would restrict screen area usable for displaying the image proper.

Now therefore, according to one of its aspects the invention is characterized according to the characterizing part of Claim 1.

The invention also relates to an apparatus arranged for practising a method according to Claim 1, and to a machine readable computer program for implementing a method as claimed in Claim 1. Feasible transfer media would be Internet and various types of data carriers, such as floppy disks. Further advantageous aspects of the invention are recited in dependent Claims.

BRIEF DESCRIPTION OF THE DRAWING

These and further aspects and advantages of the invention will be discussed in more detail hereinafter with reference to the disclosure of preferred embodiments, and in particular with reference to the appended Figures that show:

Figure 1, a medical imaging arrangement;

Figure 2, an applicable image field with sensitive areas;

Figures 3a, 3b, 3c indicate three respective grey-level windowing modes;

Figure 4 illustrates zoom and pan sensitive areas;

Figure 5 illustrates manipulating the calliper during zoom;

Figure 6 illustrates various shutters in detail;

Figure 7 illustrates various initial shutter sensitive areas;

Figure 8 illustrates defined shutter sensitive area.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 shows a medical imaging arrangement as pertaining to one or more conventional imaging technologies, such as CT, MRI, or other. The arrangement has two image monitors 10, 11, a keyboard 13, mouse 14, and a processor provided with appropriate storage 15. All these subsystems are interconnected through a suitable interconnection facility 16 that can be bus-based. I/O facility 12 interconnects to an outer world for receiving image data derived from the detection subsystem not shown for brevity, and for outputting of processed image data for long-term storage, hardcopying, and other. A user person may manipulate the image in various manners described hereinafter through mouse and/or keyboard actuations. Various other system configurations would be obvious to a person skilled in the art of image manipulating systems.

The following presents an interaction model for medical image viewing applications. It supports various image display functions. Most actions are single mouse-

button. A few features use modifier keys. Full manipulation is directly on images and associated overlay graphics. A few control panels to set preferences or default behaviour may enhance the user interface. The proposal features the following operations representing most of the operations performed on images during routine image viewing.

Operation	Description
Window	Image pixel value to grey level display mapping
Zoom & pan	Image magnification and translation
Orientation	Flipping and rotating images
Shutter	Masking irrelevant image areas
Movie & scroll	Navigation through a sequence of images

Simple operation is essential for applications used only occasionally, to avoid users getting confused. Providing a system controlled only by mouse is motivated in that virtually all systems on which viewing applications run have a mouse which is an extremely cost effective device.

Sensitive areas are used to interpret the interaction events. A sensitive area determines the meaning of a specific event such as a mouse click. Here, a user points at a specific sensitive area to perform a specific function. The advantage of sensitive areas for specific functions is that simply moving the cursor over the sensitive areas gives access to operations, keeping substantially all of the underlying image in view. All available operations are accessed via sensitive areas. The screen area on which images are displayed provides ample room for sensitive areas allocated to various routine-viewing operations.

Sensitive areas are supported through various visual cues in the form of graphics overlays and cursor shapes. Graphics overlays indicate where the sensitive areas are and the cursor shape will reflect the nature of the sensitive area under the cursor. The sensitive areas are chosen to coincide with graphics overlays used for the display image related information. For example, the sensitive area to flip an image coincides with the graphics used to indicate the orientation of the image. This saves screen area and makes the interaction intuitive.

The invention displays images in rectangular regions overlaid with various graphics objects. Such graphics objects are used for various purposes, such as:

Overlay	Usage
Text	Image related attributes: patient name, exam date, procedure code
Calliper	Distance measure indicator
Orientation codes	Orientation of image relative to patient

Image number   Defines position in image sequence

Window values   Indicates displayed pixel value range

        The graphics objects are displayed near the edges of the display to avoid occluding the central area of the image where essential image information is usually concentrated. Many graphics objects directly correspond to display functions. For example, the zoom or magnification function alters the calliper display in such a way as to reflect the magnification of the image. This leads to allocating sensitive areas corresponding to graphics overlays.

Overlay	Function
Calliper	Zoom
Orientation codes	Mirror and rotate
Image number	Scroll and movie
Window values	Grey value windowing

        Not all image display functions can be allocated in this manner. Edges of the region are allocated to shutters to allow shutters to be pulled out from the edge. The remaining display region is allocated to panning.

        The interactions defined for an individual sensitive area depend on the function thereof. Display functions and graphics creation are treated separately hereinafter. Each sensitive area has an associated cursor shape that identifies the function of the sensitive area. At each sensitive area, the cursor assumes the associated shape as a visual cue to the user as to which function is associated.

Mouse interactions generally take one of two styles:

Click-Move-Click - The interaction is performed while no mouse button is pressed.

Press-Drag-Release -The interaction is performed while a mouse button is pressed.

The form chosen is a matter of taste. The click-move-click style has the advantage that the actual mouse motion is performed without a mouse button pressed enabling a finer control. The press-drag-release style has the advantage that fewer mouse clicks are required.

Click-Move-Click

1. Move cursor to interaction position. Appropriate cursor displayed

2. Click mouse button. Optionally with one or more modifier keys.

3. Move cursor over screen. Interaction takes place.

4. Click mouse button.

Press-Drag-Release

1. Move cursor to interaction position. Appropriate cursor displayed.

2. Press mouse button. Optionally with one or more modifier keys.

3. Drag cursor over screen. Interaction takes place.

4. Release mouse button.

Actual interaction depends on the position where the mouse interaction is initiated and on the actuation of mouse buttons and modifier keys. Hereinafter, we assume the click-move-click style. All interactions can be readily converted to the press-drag-release style.

A few common image display functions performed during diagnostic image viewing are as follows. **Grey-level windowing** defines the mapping of a pixel value range to grey-level display values, by selecting either a specific pixel value range to be displayed for modalities with calibrated pixel values such as CT, or by optimizing contrast and brightness for a specific image feature. **Mirror & rotate** will flip or rotate images for orienting the image to a standard or preferred patient-related orientation, such as to compensate for incorrect insertion of a film cassette in a reader. **Zoom & pan** define the position and extent of a rectangular portion of the image to be displayed. **Shutters** will mask irrelevant or distracting image information at the image edge. Depending on image acquisition, it may contain artefacts or be saturated near the edge. **Scroll & movie** provide navigation through a sequence of images, through moving the cursor over the corresponding sensitive area and performing the relevant interaction. Each function will be detailed hereinafter.

Grey-level windowing

There are three grey-level windowing modes:

Mode	Usage	Modalities
Contrast/brightness	General purpose	All X-ray
Window width/level	Calibrated pixel-values & Large dynamic range	CT
Black/White level	Suppress background	MR, US

Each mode defines the pixel-value to display grey-level mapping through two parameters, that are defined as follows:

Parameter	Description
Contrast	Slope of grey-level mapping as percentage
Brightness	Mapping to centre distance as percentage
Window-width	Extent of mapped pixel-value range
Window-level	Pixel-value of centre of mapped pixel-value range
Black-level	Pixel-value of lower bound of mapped pixel-value range
White-level	Pixel-value of upper bound of mapped pixel-value range

The contrast parameter defines the slope of the mapping in a range from 0° to 90°.

Contrast	Slope	
0	0°	Horizontal
50	45°	Default
100	90°	Vertical

The brightness parameter defines the radius of a circle to which the linear grey-level mapping is tangent.

Brightness	Mapping
$0 < B < 50$	Tangent in lower right
50	Passes through center
$50 < B < 100$	Tangent in upper left

Grey-level mapping parameters are presented as two formatted values.

Presentation		Mapping
C55	B47	Contrast / brightness
W98	L67	Window-width / window-level
W330H	L120H	Calibrated window-width / window-level (CT)
B18	W116	Black-level / white-level

Both grey-level mapping parameters have a sensitive area.

Contrast

1. Move cursor over contrast-sensitive area. Contrast cursor is displayed.

2. Press mouse button.

3. Drag cursor up or right to increase contrast, or drag cursor down or left to decrease contrast. Image contrast is adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over contrast-sensitive area. Contrast cursor displayed.

2. Click to increase contrast. Shift-click to decrease contrast. Contrast modified by 10%.

Brightness

1. Move cursor over brightness sensitive area. Brightness cursor displayed.

2. Press mouse button.

3. Drag cursor up or right to increase brightness. Drag cursor down or left to decrease brightness. Image brightness adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over brightness sensitive area. Brightness cursor displayed.

2. Click increases brightness. Shift-click decreases brightness. Brightness modified by 10%.

Contrast and brightness

1. Move cursor over contrast or brightness sensitive area. Displays ContrastBrightness cursor.

2. Press mouse button with shift modifier.

3. Drag cursor right to increase, left to decrease contrast; up to increase, down to decrease brightness. Image contrast and brightness adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Window-width

1. Move cursor over window-width sensitive area. Contrast cursor displayed.

2. Press mouse button.

3. Drag cursor up or right to increase window-width. Drag cursor down or left to decrease window-width. Image contrast adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over window-width sensitive area. Contrast cursor displayed.

2. Click increases window-width by 10%; shift-click decreases window-width by 10%.

Window-level

1. Move cursor over window-level sensitive area. Brightness cursor displayed.

2. Press mouse button.

3. Drag cursor up or right to increase window-level. Drag cursor down or left to decrease window-level. Image brightness adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over window-level sensitive area. Brightness cursor displayed.

2. Click to increase window-level. Shift-click to decrease window-level. Window-level modified with 25% of window-width.

Window-width and window-level

1. Move cursor over width or level sensitive area. ContrastBrightness cursor displayed.

2. Press mouse button with shift modifier.

3. Drag cursor right to increase width, left to decrease width, up to increase level, down to decrease level. Image contrast and brightness adjusted. Cursor stays over sensitive area.

4. Release mouse button.

Black-level

1. Move cursor over black-level sensitive area. Brightness cursor displayed.

2. Press mouse button.

3. Drag cursor up or right to increase black-level. Drag cursor down or left to decrease black-level. Image black-level adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over black-level sensitive area. Brightness cursor displayed.

2. Click to increase black-level. Shift-click to decrease black-level. Level modified by 10%.

White-level

1. Move cursor over white-level sensitive area. Contrast cursor displayed.

2. Press mouse button.

3. Drag cursor up or right to increase white-level. Drag cursor down or left to decrease white-level. Image white-level adjusted. Cursor remains over sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over white-level sensitive area. Contrast cursor displayed.

2. Click to increase white-level. Shift-click to decrease white-level. Level modified by 10%.

Black-level and white-level

1. Move cursor over black- or white-level-sensitive area. ContrastBrightness cursor displayed.

2. Press mouse button with shift modifier.

3. Drag cursor right to increase white-level, left to decrease white-level. Drag cursor up to increase black-level, down to decrease black-level. Image contrast and brightness adjusted. Cursor remains over sensitive area.

4. Release mouse button.

The mirror and rotate display functions are combined as they both define the display orientation of the image. The function uses two sensitive areas. The patient orientation code is displayed in the sensitive area for the user of the actual image orientation and locates the position of the corresponding sensitive areas. English language orientation codes are:

Code	Patient direction
H	Head
F	Feet
A	Anterior

P	Posterior
L	Left
R	Right
?	Undefined

Combinations of these codes may define oblique orientations. If an image carries insufficient information to determine the actual orientation, the "undefined" code is displayed. There are four mirror & rotate operations:

Operation	Description
Mirror horizontal	Flips image right to left
Mirror vertical	Flips image top to bottom
Rotate clockwise	Rotates image 90° clockwise
Rotate counter-clockwise	Rotates image 90° counter-clockwise

Interacting with the appropriate sensitive area performs these operations.

Mirror horizontal

1. Move cursor over horizontal sensitive area. MirrorRotate cursor displayed.

2. Click to flip image right to left.

Mirror vertical

1. Move cursor over vertical sensitive area. MirrorRotate cursor displayed

2. Click to flip image top to bottom.

Rotate clockwise

1. Move cursor over vertical sensitive area. MirrorRotate cursor displayed

2. Press mouse button.

3. Drag cursor over horizontal sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over vertical sensitive area. MirrorRotate cursor displayed

2. Click with shift modifier to rotate image 90° clockwise.

Rotate counter-clockwise

1. Move cursor over horizontal sensitive area. MirrorRotate cursor displayed

2. Press mouse button.

3. Drag cursor over vertical sensitive area.

4. Release mouse button.

Alternatively:

1. Move cursor over horizontal sensitive area. MirrorRotate cursor displayed.

2. Click with shift modifier to rotate image 90° counter-clockwise.

Zoom & pan

The zoom and pan functions together define a region of the image to be displayed. Zoom defines the extent of the region and pan the position of the region. The zoomed region has the same aspect ratio as the image display region; it may extend beyond the edges of the image. There are four zoom modes:

Mode	Description
Fill region	Minimum zoom required to fill entire image display region
Entire image	Maximum zoom that displays entire image
True size	Unit distance in image mapped to unit distance on display
True pixel	Pixel in image mapped o pixel on display

The mode can be set via a pop-up menu. The default mode is entire image. The zoom mode defines a nominal magnification applied during image display. The zoom sensitive area is integrated with the display of the calliper. Manipulating the calliper zooms the image. Panning is performed directly on the image.

The calliper display reflects the actual magnification to transform a unit distance in the image to a unit distance on the display. The actual distance unit and the number of image pixels displayed per unit distance are displayed below the calliper. If an image carries insufficient information to perform this transformation, no distance unit is displayed. For example, the resolution of most RF images is not known unless explicitly calibrated.

Zoom

1. Move cursor over zoom sensitive area. Zoom cursor displayed.

2. Press mouse button.

3. Drag cursor to zoom image. Image is zoomed in or out as cursor is dragged.

4. Release mouse button. Calliper adjusted to reflect adjusted zoom.

To magnify the image (zoom in) the user conceptually increases the size of the calliper, increasing the image distance measure on the display. To zoom out, the user likewise decreases the size of the calliper and the image distance measure on the display. After zooming, the size of the calliper adjusts to about half the vertical size of the display region.

Pan

1. Move cursor over pan sensitive area. CrossHair cursor displayed.

2. Press mouse button.

3. Drag cursor to pan image. Image follows cursor during pan interaction.

4. Release mouse button.

The image will continue to pan even if the cursor is moved outside the pan sensitive area. There are five types of image shutters:

Type	Description
Top	Masks top edge of image
Bottom	Masks bottom edge of image
Left	Masks left edge of image
Right	Masks right edge of image
Circular	Masks circular region of image

Shutters may be combined to mask a selected region of the image. They are pulled out from the edges of the display region. If no shutter is defined, the sensitive areas are small or thin areas up against the corners or edges of the display region.

Top shutter

1. Move cursor over top sensitive area. TopShutter cursor displayed.

2. Press mouse button.

3. Drag cursor downward to required position.

4. Release mouse button.

Bottom shutter

1. Move cursor over bottom sensitive area. BottomShutter cursor displayed.

2. Press mouse button.

3. Drag cursor upward to required position.

4. Release mouse button.

Left shutter

1. Move cursor over left sensitive area. LeftShutter cursor displayed.

2. Press mouse button.

3. Drag cursor to the right to required position.

4. Release mouse button.

Right shutter

1. Move cursor over right sensitive area. RightShutter cursor displayed.

2. Press mouse button.

3. Drag cursor to the left to required position.

4. Release mouse button.

Circular shutter

1. Move cursor over circular sensitive area. CircularShutter cursor displayed.

2. Press mouse button.

3. Drag cursor inward to required position.

5   4. Release mouse button.

Initial size and position of a circular shutter are chosen such that it intersects all four corners of the (rectangular) image display region.

Editing shutters

Once a shutter is defined, its sensitive area is near the edge of the shutter. It follows the

10   position of the shutter as the shutter is defined. Shutter edit interactions are similar to shutter creation interactions.

1. Move cursor over shutter sensitive area. Appropriate shutter cursor displayed.

2. Press mouse button.

3. Drag cursor to required shutter position.

15   4. Release mouse button.

Circular shutters have a diameter and a position that can be defined as follows:

1. Move cursor over circular sensitive area. CircularShutter cursor displayed.

2. Press mouse button with shift modifier.

3. Drag cursor inward to required position.

20   4. Release mouse button.

Shutters may not always be visible. For example, a circular shutter can be completely covered by top, bottom, left and right shutters. It may be necessary to first adjust one or more shutters to make a shutter visible in order to edit it.

Scroll & movie

25   These operations assume that the images to be displayed form an ordered sequence. The image displayed is defined by the scroll position. The number of images in the sequence defines the sequence length and places an upper bound on the value of the scroll position. The scroll position ranges from 1 to the size of the sequence. If the sequence has only one image, scrolling is disabled. Scroll and movie actually provide three separate

30   operations.

Operation	Description
Paging	Incremental stepping through sequence
Scroll	Interactive positioning in sequence
Movie	Automated display of sequence

Paging allows a user to step either to the next or to the previous image in the series.

Stepping to next image.

1. Move cursor over scroll sensitive area. Scroll cursor displayed.

2. Click mouse button. Next image in sequence displayed. Image sequence position updated.

Stepping to previous image.

1. Move cursor over scroll sensitive area. Scroll cursor displayed.

2. Click mouse button with shift modifier. Previous image in sequence displayed. Image sequence position updated.

Scroll

1. Move cursor over scroll sensitive area. Scroll cursor displayed.

2. Press mouse button.

3. Drag cursor up or right to increase scroll position, down or left to decrease scroll position. Images corresponding to interactive scroll positions displayed. Image sequence position is updated as cursor is dragged. Cursor remains over scroll sensitive area.

4. Release mouse button.

Starting and stopping controls the movie.

Starting movie.

1. Move cursor over scroll sensitive area. Scroll cursor displayed.

2. Double click mouse button. Movie starts. Successive images in sequence displayed. Image sequence position updated as movie runs.

Stopping movie

1. Move cursor over scroll sensitive area. Scroll cursor displayed.

2. Click mouse button. Movie stops.

The movie can be set in one of three modes, selected e.g. by a pop-up menu on the image

Mode	Description
Forward	Cyclically displays images in sequence order
Reverse	Cyclically displays images in reverse sequence order
Bounce	Alternately displays images in forward and reverse sequence order

Sensitive areas give a mode-less interaction. However, pointing accuracy is limited, because sensitive areas are kept relatively small to avoid cluttering the display region. This requires some attention and dexterity from the user person. Further, moving the cursor to a sensitive area requires mouse motion. This may cause too much moving if various interleaved interactions are performed. Both problems distract from the image viewing

proper. For selected operations this may be overcome by allocating the left mouse button to a specific interaction, such as simply dragging over the image. The interaction may then be performed independent of the cursor location in the display. The basic interaction is:

1. Move cursor over display, not positioned over a sensitive area. Display CrossHair cursor.

5   2. Click to activate allocated interaction. Appropriate cursor displayed.

3. Move cursor over image to modify allocated parameter(s). Parameter value(s) updated as cursor is moved, and image display updated to reflect modified parameter value(s).

4. Click to terminate interaction. CrossHair cursor redisplayed.

The interactions suitable to allocated mouse interaction are grey-level windowing, scrolling,

10   zooming and panning.

Interaction	Direction	Description
Grey-level	Left	Decrease Contrast, Window width or White level
	Right	Increase Contrast, Window width or White level
	Down	Decrease Brightness, Window level or Black level
	Up	Increase Brightness, Window level or Black level
Scroll	Left	Scroll to previous image
	Right	Scroll to next image
	Down	Scroll to previous image
	Up	Scroll to next image
2D Scroll	Left	Scroll to previous image column
	Right	Scroll to next image column
	Down	Scroll to previous image row
	Up	Scroll to next image row
Zoom	Left	Decrease magnification
	Right	Increase magnification
	Down	Decrease magnification
	Up	Increase magnification
Pan	Left	Pan image left
	Right	Pan image right
	Down	Pan image down
	Up	Pan image up

The amount by which an allocated parameter value is modified, is defined by the sensitivity of the interaction: the amount of value change per unit distance of cursor moving. The sensitivity should be independent of the size of the region or the resolution of

the display so that value changes will feel the same under varying circumstances. Sensitivity may be defined as follows:

Value	Sensitivity
Contrast	5%/cm
Brightness	5%/cm
Window width	5%/cm
Window level	10% of window width/cm
Black level	5%/cm
White level	5% of difference with black level/cm
Zoom	10%/cm
Scroll	1 image/cm

Moving the cursor over the associated sensitive area and clicking performs the actual allocation. The sensitive area is highlighted to indicate the allocated parameter value. For example, to allocate grey-level windowing:

1. Move cursor over Contrast or Brightness sensitive area displays appropriate cursor.

2. Click to allocate grey-level windowing. Highlight Contrast and Brightness sensitive areas.

3. Move cursor over image. Cross Hair cursor is displayed

4. Click to start grey-level windowing. ContrastBrightness cursor displayed.

5. Move cursor over image. Grey-level parameters modified. Image display updated to reflect modified grey-level mapping.

6. Click to terminate interaction. CrossHair cursor displayed.

Steps 4, 5 and 6 may be repeated to perform successive grey-level interactions.

Keyboard operation

An IntelliMouse is a pointing device with three buttons and a wheel, the middle button activated by pressing on the wheel. The wheel allows to set a numeric parameters such as contrast and brightness values by turning (rolling) the wheel. Basic interaction is as follows:

1. Move cursor over parameter sensitive area. Appropriate cursor displayed.

2. Turn wheel outward to increase value. Turn wheel inward to decrease value. Parameter value updated as wheel is turned. Image display updated to reflect modified parameter value.

The wheel is turned in steps, each corresponding to an incremental modification of the value in question. The change for one step depends on the parameter values modified.

Value	Step size
Contrast	5%

Brightness	5%	
Window width	5%	
Window level	10% of window width	
Black level	5%	
White level	5% of difference with black level	
Zoom	10%	
Scroll	1	

Sensitivity may be set via a property panel. A further facility of the IntelliMouse allows grey-level windowing, zoom or scroll, and pan simultaneously directly on the image.

Button	Direction	Description
Left	Left	Decrease Contrast, Window width or White level
Left	Right	Increase Contrast, Window width or White level
Left	Down	Decrease Brightness, Window level or Black level
Left	Up	Increase Brightness, Window level or Black level
Wheel	Outward	Increase zoom or Next image
Wheel	Inward	Decrease zoom or Previous image
Middle	All	Pan image

The allocation of zoom or scroll to the wheel depends on the serializing of the images; scroll applies if a series is displayed and zoom if a single image is displayed. This does not conflict with the capability mentioned earlier of setting parameter values via the wheel. This is still possible by moving the cursor over the appropriate sensitive area.

As regarding the Figures in particular, Figure 2 illustrates an applicable image field with sensitive areas. The field 3 need not be to scale. All sensitive areas except one lie at the edges of the image field. The latter, 20, controls image panning but does effectively not obscure the user image. Furthermore, items 24 and 30 control a circular shutter, 28 (H) controls top/bottom flipping and rotating, 32 (L) controls left/right flipping through rotating, item 34 controls right shutter, 36 selectably controls brightness, window level or black level, 38 selectably controls contrast, window width or white level, 40 controls bottom shutter, 42 selectably controls scroll and movie, 22 controls zoom, and item 44 controls shutter left.

Figures 3a, 3b, 3c indicate three respective grey-level windowing modes. Herein, Figure 3a illustrates selecting contrast and/or brightness windows. The grey-level is a function of the pixel value. Selectably rotating towards a steeper edge produces much contrast for limited differences of pixel values, but operates only in a narrow interval of pixel

values, and vice versa. Selectably moving the edge to the left increases the overall brightness of the picture, as many pixels with the pixel values in the left hand region get maximum brightness, and vice versa. Note that the two variable in Figure 3a may be operated simultaneously.

Figure 3b illustrates selecting of window width and window level. Selectably amending the width to a greater value generally produces more pixels with intermediate grey-level values, and vice versa. Selectably amending the window level to the left produces more pixels at less than the maximum grey level, and vice versa.

Figure 3c illustrates the selecting of black and white levels. Of course, a white level, i.e. a pixel value that produces a white image pixel must always lie at a higher pixel value than a black level, i.e. a pixel value that produces a black image pixel. For the remainder, the interval between the two selectable pixel values can be chosen arbitrarily. In the above, next to the usage of straight lines, the slope may be produced in the manner of an "s" or similar curve. As to the latter, this may be produced by two selectable parameter values.

Figure 4 shows in particular zoom and pan sensitive areas. Items 20, 22 already show in Figure 2. Item 200 indicates the calliper units (top indication of measuring units). The bracketed numeral indicates the number of pixels taking place in the operation.

Figure 5 shows manipulating the calliper during zoom. The slightly greater complexity of the design was found advantageous. Clicking and dragging to the upper half of the calliper respectively magnify or minify the calliper size. For the lower half the changes are inverse.

Figure 6 illustrates various shutters in detail. Herein, the showing more or less corresponds to that of Figure 3, the right shutter been active. Figure 7 illustrates various self-explanatory various initial shutter sensitive areas. Figure 8 illustrates the sizes of various defined shutter sensitive areas, including sensitivity thereof.

Persons skilled in the art will recognize that the above disclosed method may be stored on a data carrier as a computer program that can effect or enhance an existing image processing machine to attain features of the present invention.